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54 Title of the Design A Cyclonic Upright Vacuum Cleaner  
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## Specification

1. Title of the Design      A Cyclonic Upright Vacuum Cleaner

### 2. Claims

1      A cyclonic upright vacuum cleaner comprising an external cyclone of a cylindrical shape with a bottom, and an internal cyclone of an inverted conical shape to be contained in the above external cyclone, and having a pass from a dust suction air stream inlet to the tangential direction of the top of the above external cyclone, a pass from the above external cyclone to the tangential direction of the top of the above internal cyclone, and a pass from the above internal cyclone to a suction fan device, and the above cyclonic upright vacuum cleaner being characterized by that a cyclonic device therein has a structure (A) defined below.

(A) A cyclonic device wherein two posts are arranged upright from a base of a vacuum cleaner having a dust suction air stream inlet and a suction fan device, and an internal cyclone is arranged vertically and an external cyclone is held at the end, and further a socket having air stream passes to both the cyclones is hingedly interconnected with the above base, and when the socket is upright, the external cyclone is engagedly inserted inbetween the socket and the base.

2      A cyclonic upright vacuum cleaner as set forth in claim 1, wherein two kinds of the above dust suction air stream inlet, a cleaner head arranged at the bottom of the base and a cleaner nozzle to be extended by a hose attached to the rear end of the base are arranged, and the above two are selectively switchable, and a pipe that slides freely in the above hose is arranged at the rear end of the above cleaner nozzles among these two, and the end of the above pipe may be inserted into the base, and while the suction inlet is switched to the cleaner head side, the above pipe is fixed upright and inserted into the base while being contained in the above hose, and at the moment, the socket to which the external cyclone is held by a stopping clip arranged on the cleaner nozzle is held upright.

3      A cyclonic upright vacuum cleaner as set forth in claim 1 or 2, wherein a

cylindrical dust container whose diameter is made smaller from the halfway thereof toward the top thereof is inserted into the above external cyclone so that the bottom thereof should be airtight to the bottom of the external cyclone, and when the external cyclone is engagedly inserted into the socket, the open bottom of the internal cyclone is inserted into the above dust container, and a sealing component made of a flexible material, on whose internal circumference plural ring-shaped upward walls are arranged so as to hold the lower portion of the internal cyclone at the above insertion, is arranged as means for keeping airtightness between both the cyclones.

4 A cyclonic upright vacuum cleaner as set forth in claim 1 through 3, wherein a block wall is arranged concentrically inbetween the internal wall of the above socket and the external wall of the above internal cyclone, thereby space entangled by the above two, and the upper portion of the space is interconnected via an air stream pass to the top of the internal cyclone, while the lower end of the above block wall is converged toward the external wall of the internal cyclone, thereby the lower end of the space is closed, and many ventilation-holes are made in the external circumference of the above block wall.

5 A cyclonic upright vacuum cleaner as set forth in claim 1 through 4, wherein a cylindrical dust container whose diameter is made smaller from the halfway thereof toward the top thereof is inserted into the above external cyclone so that the bottom thereof should be airtight to the bottom of the external cyclone, and when the external cyclone is engagedly inserted into the socket, the open bottom of the internal cyclone is inserted into the above dust container, and at the above insertion, a dust nonreturn component of a skirt shape expanding conically is inserted into the lower portion of the internal cyclone.

### 3. Detailed Description of the Design

#### [Field of the Design]

The present design relates to improvements of an upright vacuum cleaner equipped with a cyclonic dust collecting mechanism.

[Prior Art]

Conventionally, as prior art concerning to this kind of a vacuum cleaner, those disclosed in Patent Publications (Examined) No.62-50140 and No.62-50141 have been known to those skilled in the art.

The above prior art has related to an upright vacuum cleaner including an external cyclone of a cylindrical shape with a bottom, and an internal cyclone of an inverted conical shape to be contained in the above external cyclone, and having a pass from a dust suction air stream inlet to the tangential direction of the top of the above external cyclone, a pass from the above external cyclone to the tangential direction of the top of the above internal cyclone, and a pass from the above internal cyclone to a suction fan device, and in the conventional art, coarse dust among dust entrained together with air is first separated and accumulated by the external cyclone of lower efficiency, thereafter remaining fine dust and particles are separated and accumulated by the internal cyclone of higher efficiency.

The design under the present application provides improvements based on the prior art, and the purpose thereof is to solve possible problems in placing the prior art for production.

[Problems to be Solved by the Design]

In the present application, the technical interest is focused upon solving problems in the above prior art, especially problems with the cyclonic device thereof.

The problems are listed below.

(a) Firstly, in the above prior art, no means for removing a cyclonic device has been disclosed.

Nevertheless, in a cyclonic vacuum cleaner, dust is accumulated in a cyclone, accordingly a cyclone functions as a dust container, and for disposing collected dust, means for removing a cyclonic device has been indispensable, and the realization thereof has been desired.

(b) Secondly, in the above prior art, a structure has been adopted wherein an internal cyclone is contained in an external cyclone, while dust collected by the external cyclone is accumulated directly in the external cyclone, but dust collected by the internal cyclone must be accumulated in a container that may be separated from the

internal cyclone, and for this point, realization of means for securely keeping airtightness between the container and the internal cyclone has been desired.

(c) Thirdly, in the above prior art, since a structure has been adopted wherein an internal cyclone is contained in an external cyclone in concentric manner, an air stream pass from the external cyclone to the internal cyclone must be arranged in narrow space obtained by aperture between the two cyclones (in concrete, a pass of a flat pipe shape has been employed in the above prior art), and in the case where a filter is arranged in such narrow space, the cross sectional area of such an air stream pass being small will be clogged by sucked dust frequently, which has been another problem with the prior art.

(d) Fourthly, in the above prior art, dust is accumulated on the bottom of the external cyclone, and in some air stream conditions or in some operating angles of a vacuum cleaner, dust will made back upward, which has been still another problem with the prior art.

#### [Means to Solve the Problems]

The purpose of the present application is to provide a vacuum cleaner that enables to solve the above respective problems seen with the prior art, wherein the main portion as a vacuum cleaner is used in common, and individual designs are devised to cope with the above problems, therefore, structures of these designs are described hereinafter.

By the way, it is as mentioned above that all these designs are ones in a cyclonic upright vacuum cleaner comprising an external cyclone of a cylindrical shape with a bottom, and an internal cyclone of an inverted conical shape to be contained in the above external cyclone, and having a pass from a dust suction air stream inlet to the tangential direction of the top of the above external cyclone, a pass from the above external cyclone to the tangential direction of the top of the above internal cyclone, and a pass from the above internal cyclone to a suction fan device.

#### [First Design]

The first design is characterized by a structure of a cyclonic device wherein two posts are arranged upright from a base of a vacuum cleaner having an dust suction

air stream inlet and a suction fan device, and an internal cyclone is arranged vertically and an external cyclone is held at the end, and further a socket having air stream passes to both the cyclones is hingedly interconnected with the above base, and when the socket is upright, the external cyclone is engagedly inserted inbetween the socket and the base.

[Second Design]

The second design has the above first design in the main portion thereof, and is characterized by that further two kinds of the above dust suction air stream inlet, a cleaner head arranged at the bottom of the base and a cleaner nozzle to be extended by a hose attached to the rear end of the base, are arranged, and these two are selectively switchable, and a pipe that slides freely in the above hose is arranged at the rear end of the above cleaner nozzles among these two, and the end of the above pipe may be inserted into the base, and while the suction inlet is switched to the cleaner head side, the above pipe is fixed upright and inserted into the base while being contained in the above hose, and at the moment, the socket to which the external cyclone is held by a stopping clip arranged on the cleaner nozzle is held upright.

[Third Design]

The third design has the above first design in the main portion thereof, and is characterized by that further a cylindrical dust container whose diameter is made smaller from the halfway thereof toward the top thereof is inserted into the above external cyclone so that the bottom thereof should be airtight to the bottom of the external cyclone, and when the external cyclone is engagedly inserted into the socket, the open bottom of the internal cyclone is inserted into the above dust container, and a sealing component made of a flexible material, on whose internal circumference plural ring-shaped upward walls are arranged so as to hold the lower portion of the internal cyclone at the above insertion, is arranged as means for keeping airtightness between both the cyclones.

[Fourth Design]

The fourth design has the above first design in the main portion thereof, and is

characterized by that further a block wall is arranged concentrically inbetween the internal wall of the above socket and the external wall of the above internal cyclone, thereby space entangled by the above two is formed, and the upper portion of the space is interconnected via an air stream pass to the top of the internal cyclone, while the lower end of the above block wall is converged toward the external wall of the internal cyclone, thereby the lower end of the space is closed, and many ventilation holes are made in the external circumference of the above block wall.

#### [Fifth Design]

The fifth design has the above first design in the main portion thereof, and is characterized by that further a cylindrical dust container whose diameter is made smaller from the halfway thereof toward the top thereof is inserted into the above external cyclone so that the bottom thereof should be airtight to the bottom of the external cyclone, and when the external cyclone is engagedly inserted into the socket, the open bottom of the internal cyclone is inserted into the above dust container, and at the above insertion, a dust nonreturn component of a skirt shape expanding conically is inserted into the lower portion of the internal cyclone.

#### [Actions]

The actions of the above designs under the present application are described respectively hereinafter.

#### [Action of the First Design]

According to the first design, wherein a socket into which an external cyclone is to be inserted is hingedly interconnected with a base, it is possible to be attached or detached the cyclone by only inclining the socket pivotedly, further, in this case, since the socket functions as an air stream pass to the external cyclone, the external cyclone is closely fixed to the socket by suction during operation, therefore, there is no need to arrange any special fixing means such as screwing or the similar.

#### [Action of the Second Design]

According to the second design, the locking mechanism of a cleaner nozzle

upright on a base functions as the locking mechanism of a pivoting socket.

#### [Action of the Third Design]

According to the third design, wherein a sealing component made of a flexible material, on whose internal circumference plural ring-shaped upward walls are arranged so as to hold the lower portion of an internal cyclone, is arranged inbetween a dust container of an internal cyclone and the internal cyclone, consequently, when the internal cyclone of an inverted conical shape is inserted into the sealing component, the internal cyclone spreads out the circumferential walls one after another, and in combination with elasticity thereof, secure airtightness is obtained.

#### [Action of the Fourth Design]

According to the fourth design, wherein space between the external wall of an internal cyclone and a block wall forms part of an air stream pass from an external cyclone to the internal cyclone, further the lower end of the block wall is converged toward the external wall of the internal cyclone, and many ventilation holes are made in the external circumference of the block wall, thereby these ventilation holes function as a sidewayly opening filter, and the inlet of the air stream pass which conventionally enabled to have only a cross sectional area may be increased, moreover, the flow of air to this air stream pass is bent once from longitudinal direction to lateral direction, as a consequence, it is possible to prevent dust from being sucked.

#### [Action of the Fifth Design]

According to the fifth design, wherein a dust nonreturn component of a skirt shape expanding conically is inserted into the lower portion of an internal cyclone, dust is apt to drop in the expanding direction of the dust nonreturn component, however dust that once drops is prevented from getting back by the lower end of the expanded dust nonreturn component, consequently, dust nonreturn effect is attained.

#### [Description of Preferred Embodiment]

The design is illustrated hereinafter in more details by reference to the following referential example and preferred embodiment wherein.

For convenience of explanation, a vacuum cleaner wherein all the above designs are embodied is used as a referential example.

This vacuum cleaner is an upright vacuum cleaner comprising an external cyclone of a cylindrical shape with a bottom, and an internal cyclone of an inverted conical shape to be contained in the above external cyclone, and having a pass from a dust suction air stream inlet to the tangential direction of the top of the above external cyclone, a pass from the above external cyclone to the tangential direction of the top of the above internal cyclone, and a pass from the above internal cyclone to a suction fan device.

In the figures, the code 1 is a base of the vacuum cleaner, and a suction fan device 20 is contained in the inside thereof, and a pair of wheels 25 is arranged at the outside thereof, while at the front of the vacuum cleaner, a cleaner head 2 is pivotally interconnected, and an air stream inlet 2a with a rolling brush 3 is opened in the lower portion of the cleaner head.

From both the flat sides of the base 1, a pair of posts 4a and 4b are arranged upright, and a socket 5 is pivotally interconnected inbetween these posts 4a and 4b.

To the socket 5, an internal cyclone 10 of an inverted conical shape whose bottom end is opened is already suspended via a packing 11, and further a cylindrical component 12 is suspended from the socket via the packing 11 so as to entangle the internal cyclone, and into the bottom end of the cylindrical component, a cylindrical component 14 wherein many ventilation holes are made in the external circumference thereof and the end thereof is converged so as to contact the external circumference of the internal cyclone 10 is inserted. (Refer to Fig. 4 and Fig. 6.)

In the figure, the code 6 is an external cyclone, which is inserted via a packing 8 inbetween the socket and the upper surface of the base 1 when the above socket 5 is set upright. (Refer to Fig. 8.)

By the way, in the present preferred embodiment, so as to make secure the above insertion, a hook 1a that freely rises and falls is arranged on the base 1, and the hook is engaged with the engaging step portion 6a arranged in the external cyclone 6, thereby the external cyclone is prevented from coming out. (Refer to Fig. 3.)

The external cyclone 6 is structured by a vertical cylinder with a hand grip at one end thereof, and in the present embodiment, the external cyclone is made of a

transparent material for easy recognition of dust accumulated in the inside thereof.

And, into the bottom of the external cyclone 6, inserted via a packing 8 is a dust container 7 that is interconnected with the internal cyclone 10 and contains dust separated by the internal cyclone.

The bottom of the dust container 7 is made into a seat 7a so as to fit the internal diameter of the external cyclone 6, while the upper portion thereof from the seat is made into a cylinder 7b with smaller diameter, and to the end thereof, connected is a sealing component 9 for securing airtightness with the internal cyclone 10 to be inserted therein. (Refer to Fig. 4.)

The sealing component 9 is made of an elastic material, for example, rubber, into a cylindrical shape, and on the internal circumference thereof, plural ring-shaped upward walls 9a (4 lines in the present preferred embodiment) are arranged so as to hold the lower portion of the internal cyclone 10, while on the lower end thereof, a ring-shaped slot 9b into which the upper end of the dust container 7 is to be inserted is arranged.

By the way, the code 15 in the figure represents a dust nonreturn component, which is structured into a skirt shape expanding conically, and is placed onto the above sealing component 9, and also is inserted into the external surface of the internal cyclone 10.

In the structure mentioned above, suction air stream passes are securely configured as described hereinafter. (Refer to Fig. 10.)

First, the post 4a is made hallow, and the bottom end of the post is interconnected with the cleaner head 2 of the base 1, further the top end of the post is interconnected via a connection hose 17 to the tangential direction in the socket 5, thereby an air stream pass from the cleaner head 2 to the external cyclone 6 is secured.

Then, the above cylindrical components 12 and 14 as a block wall entangle a part of the internal cyclone 10, as a consequence, space 16 entangled by this block wall.

Accordingly, since this space 16 is interconnected with the inside of the external cyclone 6 by ventilation holes 14a made in the cylindrical component 14, this space is interconnected via a connection hose 18 to the tangential direction in the inside of the internal cyclone 10, thereby an air stream pass from the external cyclone 6 to the internal cyclone 10 is secured.

Finally, the other post 4b is made hallow, and the top end of the post is interconnected via a connection hose 19 to the inside of the internal cyclone 5, further the bottom end of the post is interconnected with the air stream pass to the suction fan device 20 of the base 1, thereby an air stream pass from the internal cyclone 10 to the suction fan device 20 is secured.

By means of the series of the above air stream passes, air containing dust sucked via the suction air stream inlet 2a of the cleaner head 2 is sucked via the post 4a and the connection hose 17 to the tangential direction of the inside of the external cyclone 6, wherein whirling movement is made, thereby coarse dust is removed and accumulated, and further air is sucked via the space 16 and the connection hose 18 to the tangential direction of the inside of the internal cyclone 10, wherein whirling movement at higher speed is carried out, thereby fine dust and particles are removed and accumulated, and thereby only clean air is exhausted via the connection hose 19 and the post 4b by the suction fan device 20.

By the way, the code 23 in the figure is another cleaner nozzle different from the above cleaner head 2.

This cleaner nozzle 23 is interconnected to the suction fan device 20 by the hose 21 arranged at the rear end of the base 1, and air stream passes are selectively switched over at necessity between this cleaner nozzle and the above cleaner head 2.

The description about this switching mechanism does not relate to the point of the present design and therefore is omitted herein, while one example thereof is to be seen in the above two publicly known documents as well as others, for instance, Patent Publication (Examined) No.62-55416, Patent Publication (Unexamined) No.55-141227, and so forth.

In the cleaner nozzle 23, the front end thereof is opened as a suction air stream inlet 23a, and at the rear end thereof, a pipe 22 that freely slides in a hose 21 is arranged (Refer to Fig. 7.), and the end of the pipe may be inserted into the base 1, thereby when the suction air stream inlet is switched to the cleaner head 2 side, the pipe is contained in the hose 21 and inserted into and fixed to the base upright, and at this moment, the cleaner nozzle 23 functions also as a handle to guide the vacuum cleaner.

The code 24 in the figure is a clip for fixing the above cleaner nozzle 23 in upright status to the socket 5 and at the same time fixing the socket upright. (Refer to

Fig. 2.)

The clip 24 may move vertically and is always energized upward, and forms a jaw between a hook portion 23a arranged at the cleaner nozzle 23 and a hook portion 24a arranged at the clip, and by means of this jaw, the clip pinches a protrusion 5a arranged at the socket 5.

[Effects of the Design]

The effects peculiar to the respective designs explained above are described hereinafter.

[Effect of the First Design]

- The cyclone may be detached and attached only by inclining the socket in the pivoted direction thereof, it becomes extremely easy to collect dust, and also maintenance may be carried out in simple and easy manners.
- As previously mentioned in the action thereof, the socket is closely fixed, there is no need to arrange any special fixing means such as screwing or the similar, and in combination with the above effect, it becomes easy to detach or attach the cyclone.

[Effect of the Second Design]

- The locking mechanism of the cleaner nozzle upright on the base functions as the locking mechanism of the pivoting socket, as a consequence, it is possible to make a vacuum cleaner with a smaller number of parts.

[Effect of the Third Design]

- As previously mentioned in the action thereof, when the internal cyclone of an inverted conical shape is inserted into the sealing component, the internal cyclone spreads out the circumferential walls one after another, and in combination with elasticity thereof, secure airtightness is obtained, as a consequence, it is possible to separate the internal cyclone from the dust container, and further it becomes extremely easy to collect dust, and also maintenance may be carried out in simple and easy manners.

[Effect of the Fourth Design]

- As previously mentioned in the action thereof, many ventilation holes are made in the external circumference of the block wall, thereby these ventilation holes function as a sidewayly opening filter, and the inlet of the air stream pass which conventionally enabled to have only a cross sectional area may be increased, moreover, the flow of air to this air stream pass is bent once from longitudinal direction to lateral direction, as a consequence, it is possible to prevent dust from being sucked, which is effective against especially long hairs of pets and the like, and it is possible to prevent dust clogging from occurring.

[Effect of the Fifth Design]

- As previously mentioned in the action thereof, by means of the dust nonreturn component, dust is prevented from returning, as a result, dust is always accumulated at the bottom of the external cyclone, and it is prevented dust from coming out at removing the external cyclone.

4. Brief Description of the Drawings

Fig. 1 is a partially cut side view of a cyclonic upright vacuum cleaner according to the present design. Fig. 2 is an enlarged side view of a cleaner nozzle thereof. Fig. 3 is an enlarged cross sectional view of the base thereof and the external cyclone portion. Fig. 4 is an exploded perspective view of the above cyclone portion. Fig. 5 is an enlarged cross sectional view of the sealing component thereof. Fig. 6 is an enlarged side view of the cylindrical component thereof. Fig. 7 is a side view showing a status wherein the above cleaner nozzle is detached and expanded. Fig. 8 is a perspective view showing a status wherein the above external cyclone is detached and attached. Fig. 9 is a front view of the above vacuum cleaner. Fig. 10 is a cross sectional view without details to show the concept of air stream passes inside of the above vacuum cleaner.

[Description of Codes]

- 1      Base
- 2      Cleaner head

- 4a, 4b Posts
- 5 Socket
- 6 External cyclone
- 7 Dust container
- 9 Sealing component
- 10 Internal cyclone
- 12 Cylindrical component
- 14 Cylindrical component
- 15 Dust nonreturn component
- 20 Suction fan device
- 21 Hose
- 22 Pipe
- 23 Cleaner nozzle
- 24 Clip

## ⑪公開実用新案公報(U) 平3-103057

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⑭考案の名称 サイクロン式縦型掃除機

⑮実 願 平2-12665

⑯出 願 平2(1990)2月9日

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## ⑳実用新案登録請求の範囲

1 有底筒状の外サイクロンと、この外サイクロンの内部に収容される逆円錐形の内サイクロンからなり、塵の吸入口から外サイクロンの頂部の接線方向へ、外サイクロンから内サイクロンの頂部の接線方向へ、内サイクロンから吸入ファン装置へそれぞれ流路を有する縦型掃除機において、サイクロン装置を下記(A)の構造としたことを特徴とするサイクロン式縦型掃除機。

(A) 嘴の吸入口及び吸入ファン装置を有する掃除機の台座より支柱を2本立設し、内サイクロンを垂設すると共に端部において外サイクロンが保持され、更に両サイクロンへの空気の流路を内部に有するソケットをこの台座間に挿動自在に枢止し、ソケットの直立時にこのソケットと台座間に外サイクロンが嵌入されるサイクロン装置。

2 嘴の吸入口を、台座下部に取り付けられたクリーナーヘッド及び台座後端に植設されたホースにより延長されるべきクリーナーノズルの2種設けると共に、これらを選択切替え可能とし、この内後者のクリーナーノズルの後端にはホース内を進退自在に摺動するパイプを設けると共に、このパイプ端を台座上に差し込み可能とし、吸入口をクリーナーヘッド側に切り換えている場合にはこのパイプはホース内に収容された状態で台座上に直立状態で差し込み固定され、この際クリーナーノズルに設けた係止クリ

ツブにより外サイクロンが保持されたソケットを直立状態で係止する請求項1記載のサイクロン式縦型掃除機。

3 中途より上方部にかけて小径とした筒状の集塵容器を下端が外サイクロンの底部に対して気密となるよう外サイクロン内に挿入すると共に、外サイクロンのソケットへの嵌入時に内サイクロンの開口底をこの集塵容器に挿入し、この挿入にあたり内サイクロンの下方部を抱持すべき上向きの環状襞を上下複数列に渡つて内周に配した弾性素材よりなるシール部材をもつて両者の気密手段とした請求項1又は2記載のサイクロン式縦型掃除機。

4 ソケット内壁と内サイクロン外壁との間に同心円状に区画壁を設けることにより両者により囲まれる空間を形成すると共に、この空間の上部を流路を経て内サイクロンの頂部に連通させ、一方この区画壁の下端を内サイクロンの外壁に向かつて収束させることによりこの空間の下端を閉じると共に、この区画壁の外周に多数の通気孔を穿設した請求項1から3のいずれかに記載のサイクロン式縦型掃除機。

5 中途より上方部にかけて小径とした筒状の集塵容器を下端が外サイクロンの底部に対して気密となるよう外サイクロン内に挿入すると共に、外サイクロンのソケットへの嵌入時に内サイクロンの開口底をこの集塵容器に挿入し、この際内サイクロンの下方に円錐状に拡散したス

カート状の塵逆止部材を外嵌した請求項1から4のいずれかに記載のサイクロン式縦型掃除機。

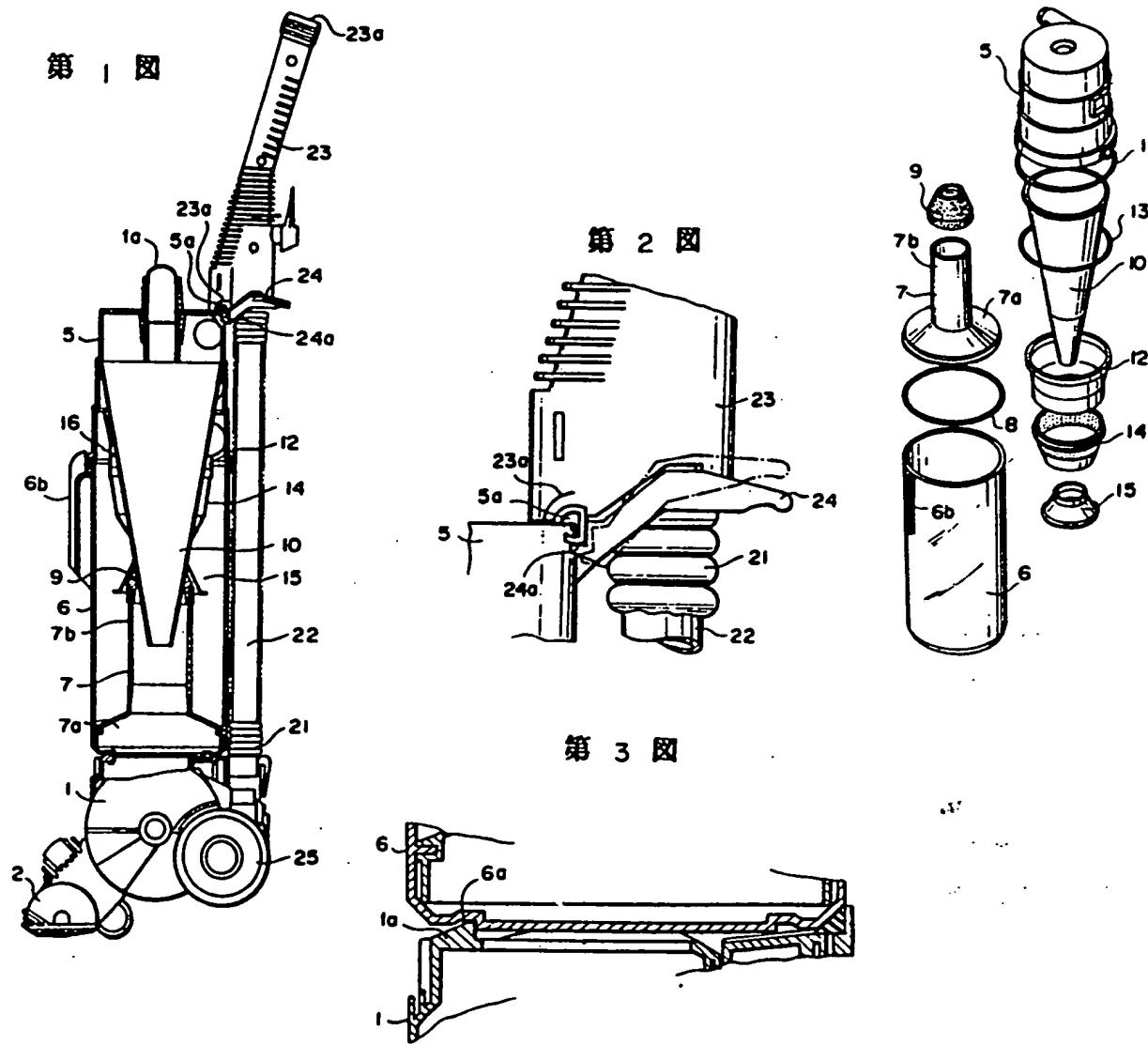
#### 図面の簡単な説明

第1図はこの考案のサイクロン式縦型掃除機の一部切り欠き側面図、第2図は同上クリーナーノズル箇所の拡大側面図、第3図は同上台座と外サイクロン箇所の拡大断面図、第4図は同上サイクロン部分の分解斜視図、第5図は同上シール部材の拡大断面図、第6図は同上筒状部材の拡大側面図、第7図は同上クリーナーノズルを外して伸ばした状態の側面図、第8図は同上外サイクロンの

脱着状態を示す斜視図、第9図は同上正面図、第10図は同上内部の空気流路の概念を示す細部を省略した状態の断面図である。

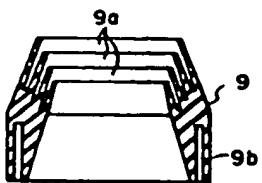
尚、図中符号、1……台座、2……クリーナーヘッド、4a, 4b……支柱、5……ソケット、6……外サイクロン、7……集塵容器、9……シール部材、10……内サイクロン、12……筒状部材、14……筒状部材、15……塵逆止部材、20……吸入ファン装置、21……ホース、22……パイプ、23……クリーナーノズル、24……クリップ。

第4図

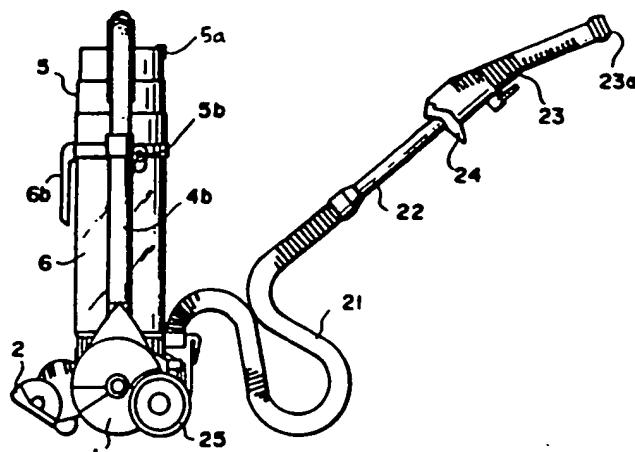


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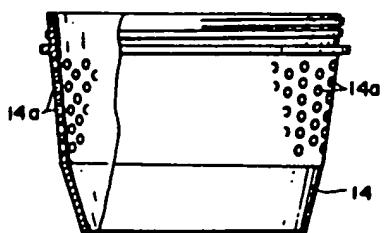
### 第 5 圖



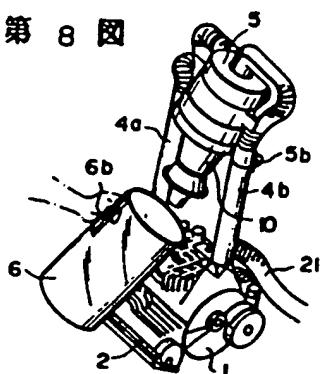
### 第 7 圖



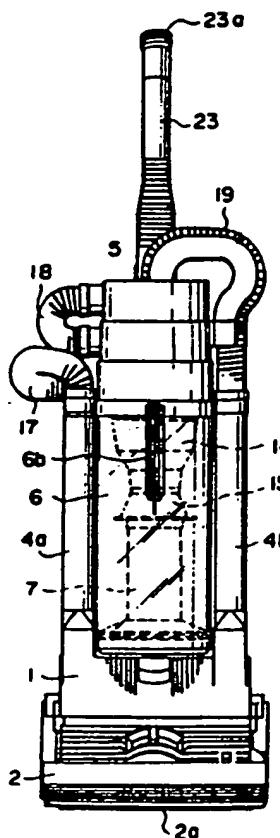
## 第 6 圖



### 第 8 圖



### 第 9 圖



### 第 10 圖

